epitiro
The Broadband Communications Authority

Ireland Internet Performance Index

Summary Findings 2008

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Executive Summary

Since 2003 Epitiro has maintained ongoing monitoring of top internet service providers (ISP) throughout the United Kingdom for the purpose of providing industry bodies with actual customer experience data of broadband service.

In 2008 Epitiro installed broadband monitoring infrastructure in Ireland and commenced monitoring urban broadband performance, in both wired and wireless (3G) formats.

This report reviews broadband performance in major cities in Ireland and aims to convey the findings from both customer and technical perspectives. Insight into the likely performance levels of popular broadband uses such as web surfing, VoIP, internet gaming and streaming video were the drivers behind the technical aspects measured.

Performance measurements were conducted using Epitiro's ISP-I™ network of satellite devices and software agents that connect to the internet and perform automated test routines. The dataset used for this report was based on over 5 million tests from August 2008 to October 2008 and the testing process remains active.

Key findings include the following:

- Irish fixed line broadband consumers receive, on average, 60.2% of the bandwidth speed advertised
- Mobile broadband achieves 64% of advertised speed, on average
- Only two of the nine ISPs tested reached over 75% of advertised speed
- Faster broadband services do not deliver equally faster web browsing speeds
- Mobile broadband had very high (slow) DNS lookup times, adding delays to the browsing process and making it considerably slower when compared to like-for-like fixed line bandwidth services
- Ping times for all ISPs exceeded the recommended limits for gaming. Mobile broadband had particularly high (slow) ping times.
- Smart Telecom was deemed the best ISP according to Epitiro's assessment methodology, reaching 76% of its advertised speed, and finishing top in several measurement categories

Due to the wide range in performance amongst ISPs and packages, Epitiro recommends that consumers fully monitor the actual service levels they receive to ensure broadband services meet their requirements. Epitiro has launched a free application that can be downloaded from www.isposure.com for consumers in Ireland to chart their actual broadband service level and compare it to other ISPs.

Introduction

Since 2003 Epitiro has benchmarked broadband performance and regularly published the UK Internet Performance Index (IPI) that examines numerous key performance indicators (KPIs) and ranks the major ISPs within the UK. In 2008 Epitiro expanded its area of coverage and established a network of automated reporting agents throughout the Republic of Ireland.

Founded on Epitiro's ISP-I™ technology that tests Internet services from the customer experience perspective, this report analyses data collected from August 2008 to October 2008 in urban areas. During this period Epitiro's network of simulated end user devices executed broadband tests on leading ISPs throughout Ireland and analysed the data that formed the basis of this report.

Scope of Testing

In the cities of Limerick, Dublin, Galway and Cork ISPs were retained to provide residential broadband service to Epitiro test satellite devices, in a mystery shopping exercise. Broadband accounts were established by the usual customer process and ISPs were not forewarned that the accounts would be used for testing purposes. Epitiro sought to subscribe to and test both fixed and mobile broadband services.

Satellite devices, simulating real residential customer activities, connected to the internet via the ISPs every 30 minutes and executed a series of tests to measure broadband performance in typical applications.

Supplementary data was collected using software agents that were randomly downloaded by the public.

ISPs Qualifying in the Research

The research project aimed to provide a general, nation-wide view of broadband services in Ireland. As such, the selection of ISPs was based on two criterion; i) the service needed to be available to a significant majority of the city dwellers and ii) of those ISPs, those offering the best services were chosen. Where Epitiro subscribed directly to ISP services, the best subscription package available in the test area was chosen. Other test data was taken from software agents that are randomly downloaded by the public (see Methodology -Data Gathering)

The following ISPs were included in the research:

(Fixed line) BT Ireland, Digiweb, Eircom, Imagine, Perlico, Smart Telecom

(Mobile) Vodafone 3G, 3 Ireland 3G, O2 3G.

Why Measure Internet Performance?

Governments across the globe have linked broadband performance quality to social and economic development. Claims by numerous research bodies endorse the importance of high-performing broadband services.

- Research from the OECD (Organization for Economic Co-operative Development) claims broadband enables the "emergence of new business models, new processes, new inventions, new and improved goods and services and it increases competitiveness and flexibility in the economy[1]." Whilst that same body of research shows the rate of uptake in Ireland to be better than average, the OECD also stated that overall services available are a concern.

- In Ireland, Forfas states that the key issue from an enterprise development perspective is the limited range and speed of broadband services available and their comparatively higher cost[2]. The importance of a competitive, high-performing broadband service for consumers, business and government is a key message in the Telecommunications and Internet Federations' (TIF) Principles to Inform the Development of Next Generation Networks and Services, where eight (8) guiding principles are discussed at length[3].

- A report prepared for the U.S. Department of Commerce concluded job growth rate levels are significantly higher in communities with superior broadband services[4]. Further research indicates that the benefits of broadband reach beyond business. Broadband technologies offer a substantial opportunity to improve the way academic education and research programs are delivered, according to a University of California study into the role of distributed broadband networks in biomedical research and education[5]. Moreover, the Australian government has linked broadband with ecology and the environment. A recent study forecasts the social patterns fostered by improved broadband in that country could cut greenhouse gas emissions by almost five per cent by 2015 and deliver up to $6.6 billion a year in financial savings for Australian businesses and households. The report predicted a reduction in Australia's carbon emissions by 4.9 per cent or around 27 million carbon tonnes per year by 2015. This is equivalent to the annual emissions caused by nearly two-thirds of Australia's passenger cars[6].

Whilst there is much data available on general coverage and pricing, Epitiro measures consumer and business broadband service levels as they are actually delivered to customers. With both global and national entities endorsing the need for widespread broadband services, measurement of those services is essential.

Methodology

Data Gathering

The data is collected and managed via Epitiro's ISP-I™ service. The ISP-I™ platform consists of a centralised database and reporting system along with deployments of ISP-I™ configured PCs or 'satellites agents', 'software agents' and 'hardware agents' that collect performance data of monitored network services. Testing is maintained 24x7 from Epitiro's Network Operating Centre.

ISP-I™ satellite agents are computers designed to automatically connect to the internet and run tests via a subscribed broadband connection. The specification of the computer is typical of one available for home use. ISP-I™ satellite agents use the same underlying mechanisms as an end user connecting to the Internet and to the services made available via their ISP. The satellite agents are housed in a controlled environment, in the target cities. Epitiro subscribed to the premium broadband services available from ISPs in the target cities.

ISP-I™ hardware agents are installed in residential homes and connect to end user modems to conduct active broadband tests on a 24x7 basis. The benefit of this method is the 'always-on' capability.

ISP-I™ software agents report performance measurements and also inform end users of their network performance. ISP-I™ software agents are downloaded randomly by the general public from www.isposure.com (see About Isposure) and are active whenever the user is on-line. Being a software application, this monitoring agent can be easily extended to rural and remote users.

All agents report the results of numerous test metrics to Epitiro's central database.

With the three methods of collecting actual broadband performance data Epitiro is able to analyse broadband services thoroughly in terms of accuracy and scope.

Data Processing and Analysis

The data is first qualified with attention to unusual findings of metrics that are then individually analysed and vetted for accuracy. The validated database formed the basis for this report.

The period of analysis in this case represents data from August to October 2008, with the test apparatus operating continuously 24x7 and performing tests at regular intervals. Over 5 million tests were conducted.

Not all metrics measured appear in the report. VoIP Quality, Traffic Management Practices, Email Success and other metrics that affect end user experience of special applications such as internet telephony, video streaming and P2P file sharing are available from Epitiro.

Overall rankings are based on data presented in the report plus consideration of other metrics not specifically covered. To determine the overall rankings Epitiro utilises a proprietary algorithm to subjectively weigh a wide range of metrics that affect customer experience.

End User Experience in Context

The recent 2008 Traffic Analysis[7] report from Sandvine reveals P2P files comprise 35.5% of all traffic, followed by web browsing at 32% and streaming at 18%.

However, browsing, e-commerce, emailing and other non-downloading activities still represent the highest proportion of user-invoked tasks, according to the Ofcom UK Communications Market Review 2008[8].

Consequently Epitiro structured this report on metrics indicative of five popular tasks;

Web Browsing (Surfing the Net)

The web browsing quality of experience is generally associated with the time it takes to locate and download a web page within a web browser application. The speed or bandwidth of a customer's connection is one a factor that contributes to the overall experience. In this report Epitiro examines underlying aspects such as TCP Throughput speeds, cached and non-cached HTTP download speeds and DNS Server resolution times.

File Sharing (Movies & Music Downloads)

P2P is becoming increasingly – and legitimately - popular as a method of transferring media files (movies and music). ISPs necessarily limit the amount of P2P traffic during peak times in order to allow the internet to be used by all. Epitiro has provided a recent snapshot of traffic management activities.

Voice over IP Telephony (VoIP)

VoIP telephony is available at various levels from free (Skype) through to paid subscription landline, to emerging femtocell unmanaged network (UMA) mobile calls. Packet Loss, a key aspect affecting IP voice is researched in this report.

IPTV/On-Line Media

End users are now running applications such as streaming of internet music, on-line radio stations and video media. Again, packet loss is one essential metric this report investigates as an indication of potential customer experience.

Gaming

Interactive gaming on the web – Xbox, Sony Playstation – allows end users around the globe to compete but relies on the internet to be responsive to player commands. Ping time is examined as a leading indicator of gaming quality of experience.

Key Performance Indicators (KPI)

'Up To' Comparisons / TCP Throughput Speed

Recently advertising standards groups have paid particular attention to the claims made by ISPs in regards to download speeds. One KPI investigated in the report is the average speed achieved versus the 'up to' speed advertised on the service purchased.

This metric is achieved by measuring the TCP throughput speed on Port 80. A percentage of achievement is then calculated.

HTTP Download Speed

The HTTP download speed test indicates how quickly an ISP can download website content. The HTTP test makes a request to the specified URL and records the time taken and the amount of data downloaded, from which the speed of the download is derived. ISP-I™ devices are also able to download the embedded content, such as images on a web page, and factor this into the speed calculations.

Epitiro selected a basket of the most frequently accessed local and international websites, in order to make the cities and urban areas directly comparable.

Traffic Management

While speed tests reveal ISPs at their best, ISPs may limit some types of high-bandwidth/low-priority traffic during peak times such that they can cope with overall demand for internet usage. These tests, over various Ports, show the extent to which ISPs limit various types of traffic and give an indication of the true consumer experience.

Ping performance:

Ping times are used to assess the responsiveness of a broadband connection, largely for the purposes of interactive gaming. A 'ping' is the time taken for an ISP-I™ device to send a request to a remote server and for that server to respond with an acknowledgement. The ping test measures network latency by sending an ICMP echo request to a specified server within each city. The time recorded by the ISP-I™ satellite is the total round trip time (in milliseconds) from the request to the echo response being received from the server. The ping test is conducted on the same basket of URLs used in the HTTP tests.

DNS Lookup Time:

A DNS server takes an address readable by humans (e.g. www.google.ie) and converts the address to an IP address, or a specific set of numbers which identifies a particular website. The quicker this happens, the more promptly the Internet will respond to a click on a hyperlink or resolve a web address. DNS test records the time taken (in milliseconds) to resolve a fully qualified domain name to a corresponding IP address. ISP-I ™ ensures that the DNS query is performed on the DNS servers, and not returned from any local cache.

Packet Loss performance:

Real-time applications such as streaming video and voice require virtually uninterrupted transmissions. The internet transmits information as a string of packets, which are sent to a destination often via different paths. One of the hazards they face is that they may be lost and have to be resent, resulting in a delay in the transmitted material. Effectively this disrupts speech in VoIP calls[9]. The packet loss test records the average package loss percentage experienced during individual tests.

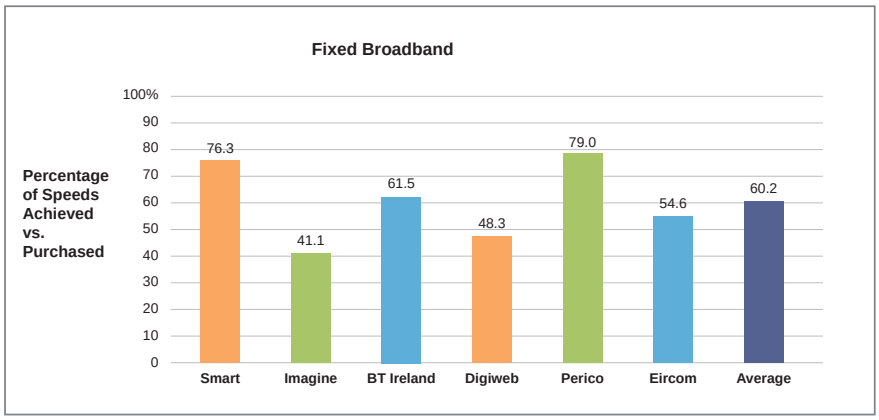
ISP Key Performance Indicator Results

TCP Download Speed – 'Up To' by Percentage

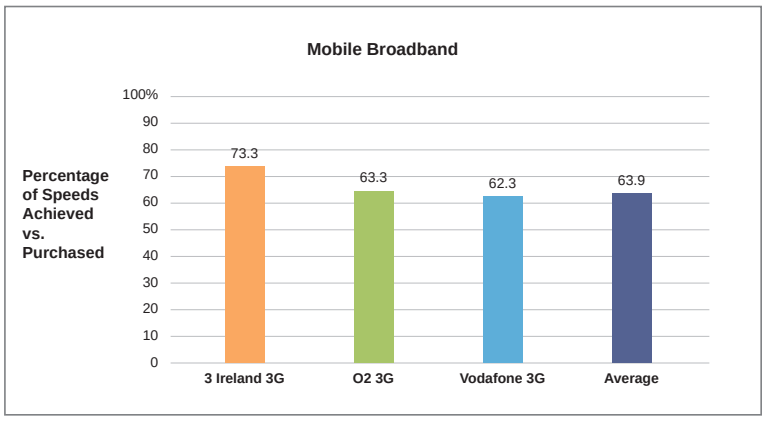
One of the growing concerns amongst broadband consumers is the difference in download speed advertised versus the speeds actually delivered. In DSL, cable and mobile broadband there are accepted technical challenges that impact the ability of an ISP to deliver service to the speeds advertised. That said, consumers (residential and business) want to understand the actual speed or 'bandwidth' delivered.

Downloading data requires more bandwidth or speed and as such download speed is the focal point for this section of the report.

The charts show the average speeds achieved vs. the 'up to' advertised. Comparisons are made on a per ISP basis, averaged across Cork, Dublin, Galway, and Limerick.



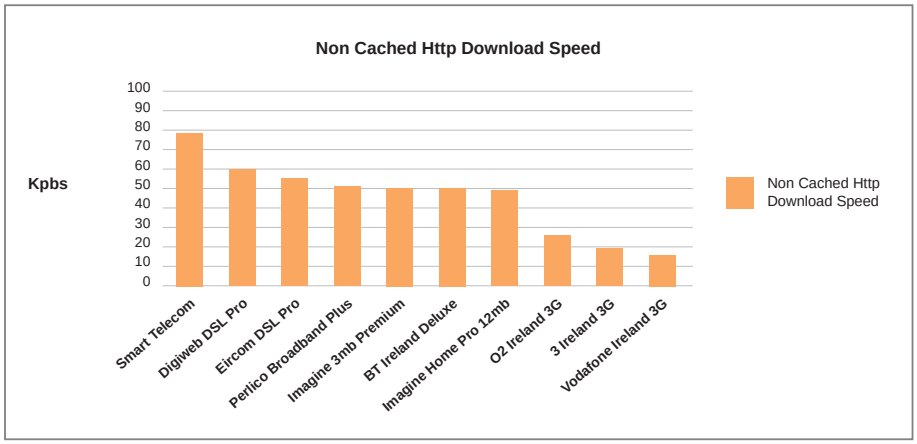
ISPs Perlico and Smart had the best performing internet services in terms of percentage achieved vs. 'up to' speeds advertised. Whilst Smart achieved 76% of the fastest service monitored in the report, Perlico achieved 79% of a 3 Mb/sec service. Overall, the fixed line ISPs managed to deliver services at an average of 60.2% of the advertised 'up to' speeds.



Mobile broadband had a slightly higher percentage (63.9% avg.) achieved rating than fixed broadband (60.2%). Generally, speeds ranging 1.7 Mb/sec to 2.4 Mb/sec were routinely measured and compared against mobile package 'up to' speeds of approximately 3 Mb/sec.

Non-Cached HTTP Download Speed

The non-cached HTTP speed is representative of the time it takes an ISP to locate and download a website. These speeds indicate the average rate at which a basket of web pages, including images, were downloaded. Server processing times, DNS resolution time, network congestion and last mile bandwidth (sync speed) are all factors affecting HTTP download speed. Faster speeds indicate that the web page will be downloaded quickly.

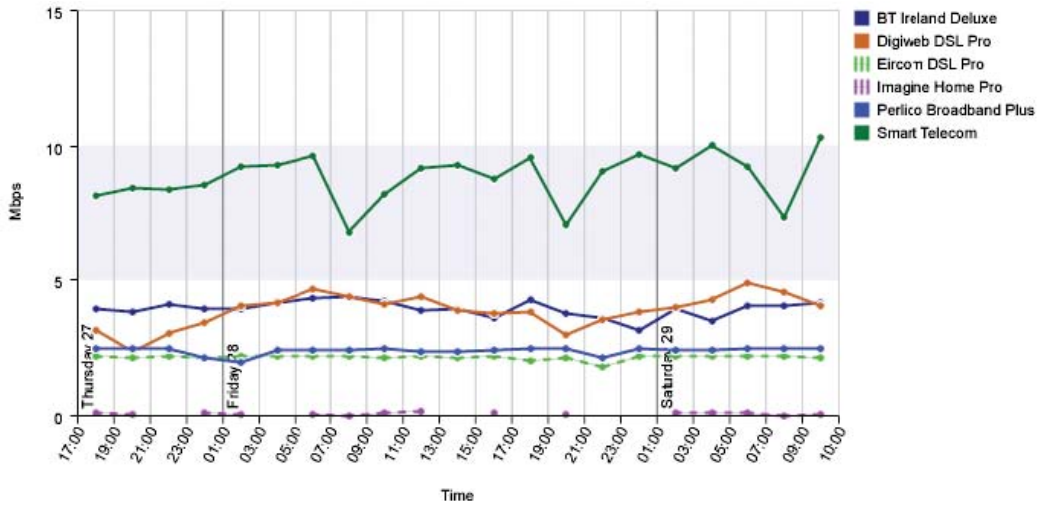


Testing confirmed that the faster broadband packages did perform HTTP (web browsing) faster than lower-speed services yet not to a significant degree. That is, Smart Telecom's 24Mb service performed only 25% better than Perlico's 3 Mb service. Note that Imagine's 3Mb service was slightly faster than its 12 Mb service for HTTP downloads, hence the inclusion of these as separate, interesting entries. The 3G services from mobile ISPs were the slowest for surfing the web.

Traffic Management

ISPs in Ireland share the same issues as those in other countries in that there is a finite limit to the amount of simultaneous traffic they can concurrently process. ISPs may limit the bandwidth they provide for downloading movies and audio files, and prioritise web surfing and email traffic.

Below is a very recent graph taken directly from the ISP-I™ reporting tool, studying Traffic Management practices in Galway and Dublin from November 27th – 29th.



ISP-I™ Traffic Management View – Dublin Galway, Bit Torrent

With the exception of Smart Telecom, the graph shows a reasonably steady rate of service for downloading Bit Torrent files, a P2P type of traffic which is typically de-prioritised when ISPs invoke traffic management policies. There are no dips in performance around the peak times of day (16:00 – 21:00), indicating that Traffic Management was not occurring at these locations.

However, Smart Telecom's service diminished at times for the locations monitored, probably due to contention. Though Smart Telecom's service remains considerably faster than the others, service levels dip during the peak period Friday evening and oddly at 8 a.m. Friday and Saturday. Digiweb's performance dips slightly, again likely due to contention, during peak periods. Imagine Home Pro struggles to deliver Bit Torrent traffic at all for these locations. The other ISPs deliver steady service.

Ping Time

The average ping time for Ireland is 194 milliseconds, which is well above the maximum acceptable time of 100 milliseconds that avid gamers use as a ceiling.

ISP	Average Rate
Smart Telecom	140 msec
Eircom DSL Pro	152 msec
Imagine Premium	153 msec
Digiweb DSL Pro	155 msec
Perlico Broadband Plus	158 msec
BT Ireland Deluxe	167 msec
O2 Ireland 3G	251 msec
3 Ireland 3G	273 msec
Vodafone Ireland 3G	391 msec

None of Ireland's ISPs showed Ping Times that would be considered acceptable by competitive internet game players. Mobile broadband has very slow ping times.

DNS Resolution Time

The ability to quickly reconcile a URL with an IP address is a key factor that influences customer experience. The recently published European City Internet Performance Index (Preliminary Report) showed the average DNS lookup speed for European ISPs at 43 milliseconds with the slowest average time was 106 milliseconds by an ISP in Lisbon.

ISP	Average Rate
Smart Telecom	37 msec
Perlico	42 msec
BT Ireland Deluxe	48 msec
Digiweb DSL Pro	53 msec
Imagine	67 msec
Eircom DSL Pro	116 msec
O2 Ireland 3G	140 msec
3 Ireland 3G	232 msec
Vodafone Ireland 3G	408 msec

Both Smart Telecom and Perlico managed to measure below the European average with other ISPs offering comparable services. Eircom and the mobile broadband services had considerably slow DNS lookup times.

Packet Loss

As described earlier in the document, Packet Loss is a useful metric of real-time media (VoIP, Streaming Video). Excessive Packet Loss can undo the benefits of high bandwidth or make low bandwidth services intolerable as it may cause experience-affecting delays to the end user whilst data is re-transmitted.

ISP	Average Rate
Eircom DSL Pro	0.04%
Digiweb DSL Pro	0.05%
O2 Ireland 3G	0.05%
BT Ireland Deluxe	0.07%
Smart Telecom	0.07%
Imagine Premium	0.08%
3 Ireland 3G	0.10%
Perlico Broadband Plus	0.41%
Vodafone Ireland 3G	0.87%

Packet Loss levels tend to increase with the speed of service as limiting factors such as network congestion and the quality of the infrastructure may cause issues. Typically packet loss occurs in an instant when networks are unable to cope with data traffic volumes.

The metric used in this report looks at total loss over a period of time. Whilst this view is conventional and a de facto standard, the stop / start 'bursty' nature of packet loss may be better expressed in the number of words dropped (VoIP) or visible judder (video).

Assuming a telephone speech rate of 200 words per minute, a typical rate according to a study from the University of Pennsylvania[9], Perlico's .41% would drop 2 words per minute of VoIP conversation. Vodafone's .87% packet loss may make the service undesirable for video streaming depending on the nature of the packet loss. O2 had an impressive packet loss rating as a 3G operator and was considerably better than competitive mobile providers.

Overall ISP Ranking

Based on a proprietary algorithm that considers the metrics discussed in this report (Percentage Achieved vs. Purchased TCP Throughput Speed, Non-Cached HTTP Download speed, Ping Time, DNS Lookup Time and Packet Loss) plus in consideration of other metrics measured throughout the analysis period, Epitiro considers Smart Telecom the best performing ISP in Ireland, followed by BT Ireland and Digiweb.

Overall Rank	ISP
1	**Smart Telecom**
2	BT Ireland
3	Digiweb

Dublin Compared to European Cities

Epitiro recently published a preliminary findings report comparing broadband services throughout eight cities in Europe, including Dublin. Based on the number of firsts in both Average and Individual ISP performance, the report found London the best European city for broadband, followed by Amsterdam and Zurich. Dublin was 7th.

Overall Rank	European City
1	London
2	Amsterdam
3	Zurich
4	Paris
5	Madrid
6	Lisbon
7	**Dublin**
8	Milan

The European Internet Performance Index Preliminary Report 2008 can be downloaded from Epitiro's web site www.epitiro.com.

Conclusions

Percentage of Speeds Achieved vs. Purchased

Most ISPs struggle to deliver services approaching the 'up to' speeds advertised, especially when downloading P2P traffic. Moreover, in peak periods, some ISPs that offer higher-speed packages may struggle to deliver more than 50% of advertised speeds.

Consequently, speeds achieved versus those advertised vary significantly in Ireland.

Browsing

The most indicative parameters of Web Browsing - HTTP Download speed and DNS Resolution Time – reveal that most fixed line ISPs offer good service for surfing the net. Mobile broadband has much slower times perhaps making the service less desirable and not likely in competition (technically) where fixed line broadband is available.

Gaming

With no ISPs under the 100msec preference, gaming capabilities in Ireland remains a concern. Mobile broadband has highly undesirable ping times.

Entertainment & Communications

VoIP and media streaming appears to be possible over many ISPs, according to the low packet loss averages. However, customer experience for these real-time applications is comprised of many simultaneous factors, including Traffic Management policies that target VoIP, P2P and other bandwidth intensive traffic. Further examination will be required to draw conclusions on the actual quality of experience associated with VoIP and streaming media in Ireland.

Though much more insight will be gleaned from further testing and monitoring of Ireland's internet service providers, this report shows ISP service levels remain varied amongst ISPs. Further, fixed broadband services appear to provide better performance than mobile broadband.

Recommendations

With performance levels varying significantly Epitiro at this time suggests businesses and consumers ensure they select ISPs to meet their needs and recommends the followings steps;

- Business and consumers should be familiar with the KPIs in this report for the purposes of understanding internet services
- Business and consumers should be aware of their ISP's traffic management polices as high-speed services may be reduced during peak periods for some types of traffic
- Businesses and consumers should equip themselves with suitable broadband analysis tools or sources of information such that they may make informed decisions
- For end users that desire the best performance, fixed broadband at its worst is superior to any mobile broadband and thus should be the first choice, where choice is available
- Epitiro recommends all interested parties remain informed of broadband service levels in their respective geographical areas

Ongoing Analysis – Rural and Urban Ireland

Epitiro cautions that this report considers broadband services in urban communities only. Using isposure (see description) Epitiro intends to investigate the level of broadband services in rural areas and provide comparative urban/rural reporting in 2009.

Additionally, Epitiro will strive to report on customer experience with email, VoIP, Femtocells and IPTV in future reports.

About Isposure

Epitiro collects some of its data based on software agents that are downloaded randomly by the public. The site www.isposure.com offers members of the public the means to see the average speeds over a period of time, plus compare their performance against the other ISP services available in their local area.

The data collected by the isposure application will provide an increasingly wide-spread view of broadband performance throughout Ireland as presence of the application proliferates.

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About Epitiro

Epitiro is the global leader in comparative broadband benchmarking providing customer experience insight to ISPs, cellular and fixed line operators, media providers, multi-national corporations and government regulators.

Voice, video and internet performance levels are benchmarked via Epitiro's extensive deployment of ISP-I™ edge-based devices with results available through an on-line database access service or the regularly published Internet Performance Index™ report. The company also provides bespoke test and benchmarking solutions with products such as DataLite™, VocaLite™ and the Femtocell Test Suite™.

Clients such as BT, Orange, Virgin, Vodafone, Telecom New Zealand, Ofcom, Tiscali, KPN and many others benefit from Epitiro's coverage of fixed and wireless broadband performance.

Founded in 2000, Epitiro is based in Cardiff, Wales, UK.

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